Roles and Approaches to Managing Prescribed Fire Smoke

Pete Lahm
Forest Service
Fire and Aviation Management
Washington, D.C.
202-205-1084 // **602-432-2614 cell**
661-GET-1ARA
Plahm@fs.fed.us // pete.lahm@gmail.com

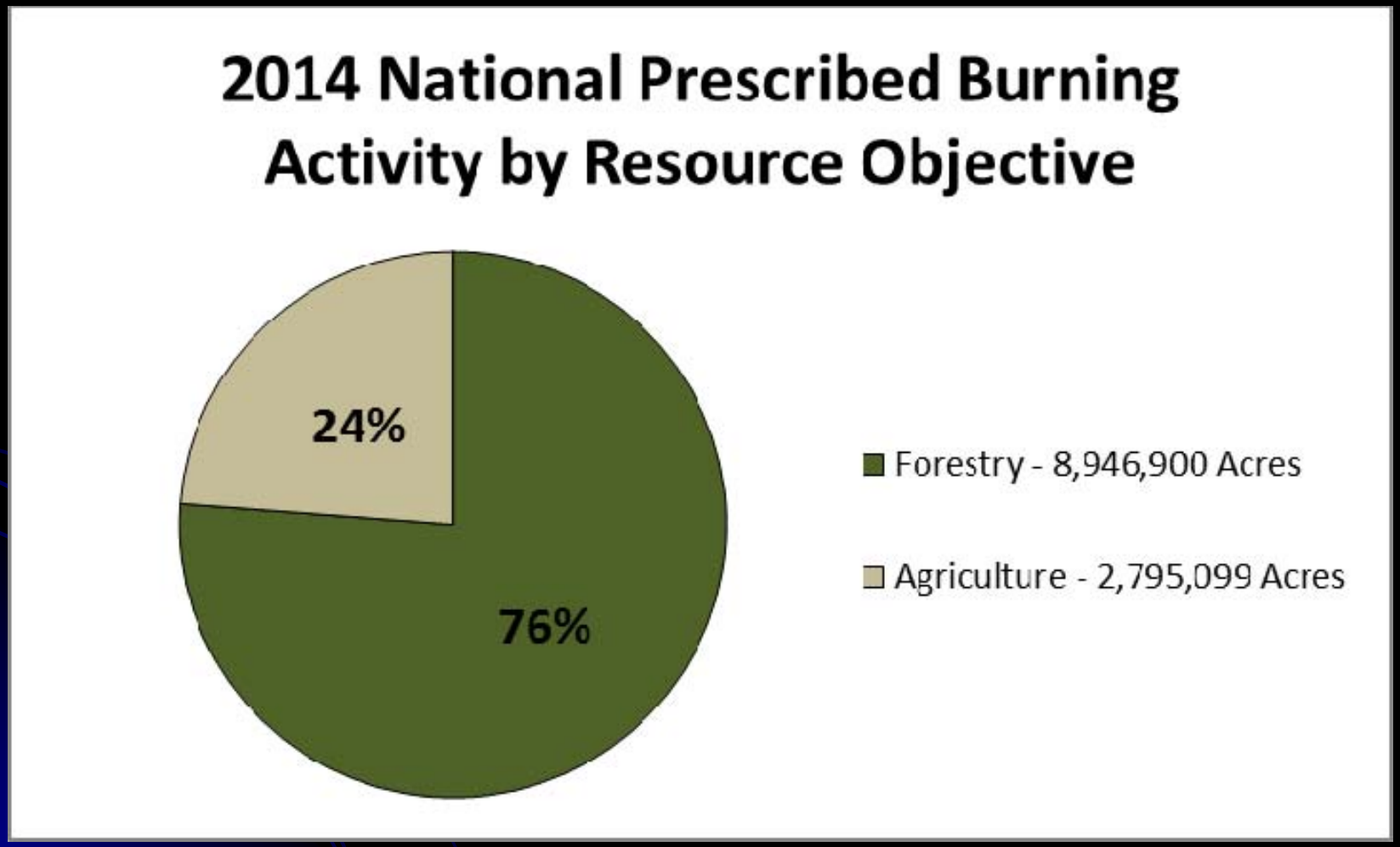
The Context…

- One in three households has someone with respiratory issues: child with asthma, COPD, emphysema, etc. 26 million have asthma in US.
- Conditions: asthma (7.3% prevalence), COPD (6.3% prevalence), chronic rhinitis (20% prevalence), pneumonia, lung cancer & other (CDC).
- Sensitive groups at risk: people with asthma, older adults and those of low income. Science indicates: pregnant women, diabetics.

- Regulatory Drivers for addressing smoke
  - Regional Haze Rule
  - Identified source in nonattainment (historically was not a big cause of exceedances)
  - General Conformity and Exceptional Event Rule
  - PM and Ozone Implementation Rules

- Nuisance…
- And now wildland and agricultural fires contributing to more than 40% of PM2.5 based on the EPA's 2011 National Emission Inventory

2015 National Prescribed Fire Use Survey: Coalition of Prescribed Fire Councils & National Association of State Foresters



Slightly up from 2011 Survey…

Smoke Management Approaches

- Basic Smoke Management Practices
  - The building block of all smoke management effort
  - Applied by individual burners
- Smoke Management Program (SMP)
  - Typically state/tribe-level
  - Recognizes 1998 Interim Policy SMP elements
- Enhanced Smoke Management Program (ESMP) (Regional Haze Rule – Section 309)
  - Recognizes ESMP Development that establishes elements needed when prescribed fire contributes to visibility impairment

Basis Smoke Management Practice	Benefits achieved with the BSMP	When the BSMP is Applied – Before/During/After the Burn
Evaluate Smoke Dispersion Conditions	Minimize smoke impacts	Before, During, After
Monitor Effects on Air Quality	Be aware of where the smoke is going and degree it impacts air quality	Before, During, After
Record-Keeping/Maintain a Burn/Smoke Journal	Retain information about the weather, burn and smoke. If air quality problems occur, documentation helps analyze and address air regulatory issues.	Before, During, After
Communication – Public Notification	Notify neighbors and those potentially impacted by smoke, especially sensitive receptors.	Before, During
Consider Emission Reduction Techniques	Reducing emissions through mechanisms such as reducing fuel loading can reduce downwind impacts.	Before, During, After
Share the Airshed – Coordination of Area Burning	Coordinate multiple burns in the area to manage exposure of the public to smoke.	Before, During, After

[a] The EPA believes that elements of these BSMP could also be practical and beneficial to apply to wildfires for areas likely to experience recurring wildfires.

[b] The listing of BSMP in this table is not intended to be all-inclusive. Not all BSMP are appropriate for all burns. Goals for applicability should retain flexibility to allow for onsite variation and site-specific conditions that can be variable on the day of the burn. Burn managers can consider other appropriate BSMP as they become available due to technological advancement or programmatic refinement.

Smoke Management Program-EER 2016

- Authorization to Burn
  - Process for authorizing prescribed fires on wildland
  - Responsible central authority
- Minimizing Air Pollutant Emissions
  - Encourages consideration of alternative treatments to fire
  - Follow appropriate emission reduction techniques
- Smoke Management Components of Burn Plans
  - If burn plans, should include
    - Actions to minimize fire emissions
    - approaches to evaluate smoke dispersion
    - public notification and exposure reduction procedures
    - air quality monitoring
- Public Education and Awareness
  - Establishes the criteria for issuing health advisories when necessary and procedures for notifying potentially affected populations.

- Surveillance and Enforcement
  - Procedures to ensure compliance with the terms of the SMP.
- Program Evaluation
  - Periodic review of effectiveness
  - Consider the role of prescribed fire in meeting the goals to establish, restore and/or maintain a sustainable and resilient wildland ecosystem and/or to preserve endangered or threatened species.
  - Review air quality impacts, post-burn reports, use of smoke contingency plans
  - Recommendations for future improvements
  - Establish frequency of review
- Certified, Permits (daily or by condition), Voluntary, State Forestry Program, Area Program, Cited in SIP, SIP with federally enforceable provisions (RHR)

Basic Smoke Management Practices

USDA –Natural Resources Conservation Service and Forest Service Tech Note

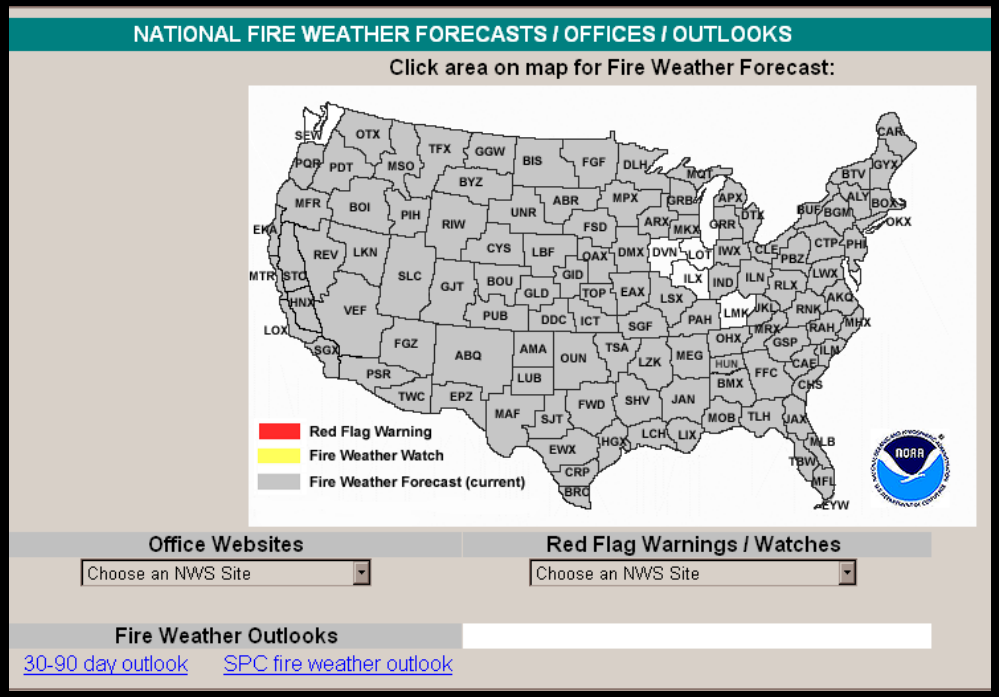
- **<u>Six Basic Smoke Management Practices</u> (BSMPs)**
- **BSMPs have been used in prescribed fire EER documentation successfully**
- **Basic individual burn level of effort managing smoke**
- **Applicable to wildlands & agriculture**

BSMP 1: Evaluate smoke dispersion conditions to minimize smoke impacts

- Before
  - Identify smoke sensitive areas
  - Identify meteorological conditions
- During
  - (critical) Obtain latest meteorological forecast
  - Obtain AQ conditions (AIRNOW) or state/local
  - Verify forecast with observations (RAWS or other)
- After, burn operations
  - Assess smoldering conditions

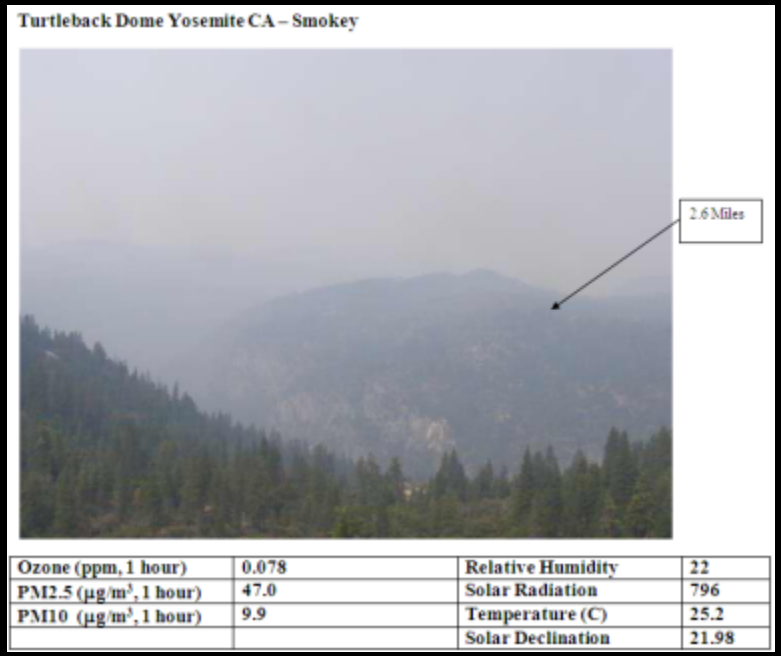
NOAA NWS Fire Weather Forecasts and Observations

- Parameters:
  - Temperature
  - Relative Humidity
  - 20 ft winds
  - Transport winds
  - Smoke Dispersal
  - Mixing Height
  - Haines Index
  - Ventilation
- Text Products
- http://fire.boi.noaa.gov/
- http://www.noaawatch.gov/themes/fire.php
  - Rangeland Fire Danger Forecasts
- Spot weather forecasts and Hysplit run



BSMP 2: Monitor the effects of the fire on air quality

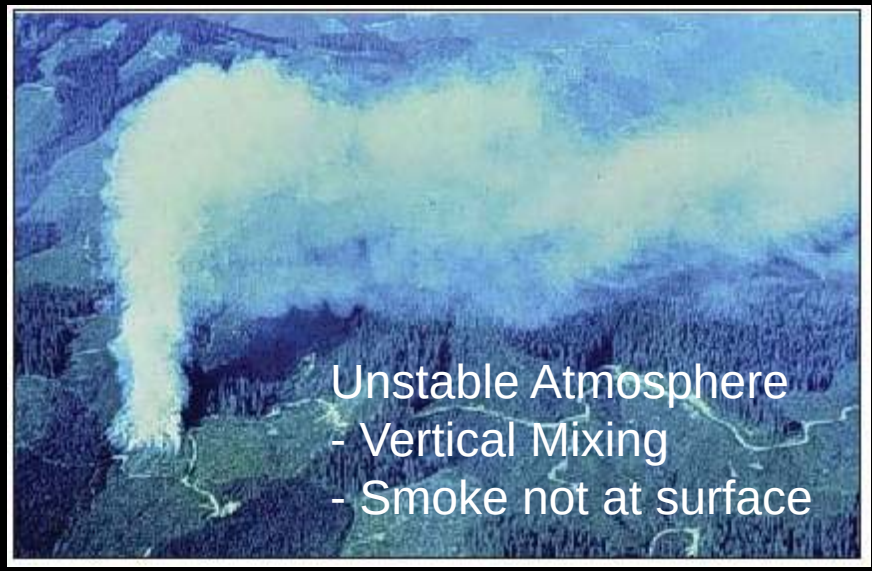
- Assess air quality conditions/forecasts
- Monitoring effects of fire on air quality
  - Where does the smoke go?
  - How high does it go?
  - Does the smoke disperse or is tight and dense?
- Methods
  - Visual monitoring notes/photographs, aircraft observations, satellite imagery,
  - Air quality monitoring data,
- Focus on air quality near sensitive receptors



US Forest Service Smoke Photo Series

Smoke Behavior
Atmospheric Dispersion

- Knowledge of the atmosphere can help with managing smoke
- Fire Weather and Dispersion Modeling can inform no/no-go burn decisions to optimize dispersion



Smoke Behavior
Valley Flows


Photo by Roger Ottmar.

- Smoke caught under a valley inversion

- Smoke can be transported by down-valley winds in the morning

BSMP 3: Record-keeping

- Keep a personal burn/smoke journal.
- What records to keep?
  - Weather (forecasted and observed)
  - BSMPs applied
  - Fire activity (location, area burned, date, ignition time, etc.)
  - Burned acreage (BLACK)
  - Fuel types and consumed
  - Smoke behavior & impacts (if any)
- Assess conditions and burns that meet goals, and provide lessons learned
- Documentation can be key if there is an air quality exceedance and the state seeks to exclude the data. KEEP FOR 5 YEARS!

BSMP 4: Communication – Public Notification

- Notify appropriate authorities (ex. air regulators, public health officials, local fire dept).
- Notify those in the public potentially affected by smoke
- Develop smoke contingency plans (SSA's, roads, etc.)
- If an impact occurs, implement contingency actions to reduce exposure (ex. Communication about impacts & response, mop-up, reducing area burned).

BSMP 5: Consider use of emission reduction techniques (ERTs)

- Ensure objectives are not compromised as ERT's are site specific
- ERTs can include:
  - reducing fuel burned
  - increasing burning efficiency
  - Backing fire….
- Document use of ERT's for NEPA, SMP, SIP or EER use later.

BSMP 6: Share the Airshed – Coordination of Area Burning

- Communication among fire managers burning in the same vicinity on the same day
- Coordinate and plan ignitions so as not to overwhelm the ability of the atmosphere to disperse the smoke
- Current smoke/AQ information
  - AIRNOW (http://www.airnow.gov) or from local/state air quality monitoring networks.
  - NOAA Hazard Mapping System – current satellite fire detections (http://www.osdpd.noaa.gov/ml/land/hms.html)
- Share communications with public

Smoke Management Approaches

- Basic Smoke Management Practices
  - The building block of all smoke management effort
  - Applied by individual burners
- Smoke Management Program (SMP)
  - Typically state/tribe-level
  - Recognizes 1998 Interim Policy SMP elements
- Enhanced Smoke Management Program (ESMP) (Regional Haze Rule – Section 309)
  - Recognizes ESMP Development that establishes elements needed when prescribed fire contributes to visibility impairment

Enhanced Smoke Management Program

- Regional Haze Rule – Section 309
- Limited Use
- Added annual emission goal through use of emission reduction techniques (PM2.5)
- Importance of tracking emissions, ERTs and regional coordination

Federal Land Manager Policies (USFS, BLM, NPS, FWS, BIA) and Roles

- NWCG Interagency Prescribed Fire Planning and Implementation Procedures Guide
  - Expectations for prescribed burning, planning for smoke, implementation and response when unplanned smoke impacts occur (AAR)
- Training Requirements - Prescribed Fire Boss
  - RX-410 Smoke Management Techniques
  - Regionally taught classes (some state forestry)
- NWCG Prescribed Fire Smoke Management Guide out in early 2017 (see poster at ISS2)

Federal Land Manager Policies (USFS, BLM, NPS, FWS, BIA) and Roles

- Forest Service - FSM 5140 Policy on Rx Fire
  - Use of BSMP required
    - explicit tracking will need to be added
  - NOV or exceedance reporting and AAR requirements

Wildland Fire – Federal Land Manager Roles

- EER Wildland Fire = Two types of fire, Wildfire and Prescribed Fire
  - Characterizing the source and smoke movement
    - Envisioned as a collaborative process
    - Process is being developed internally (FS) to support these needs
- Daily Perimeter Growth (Blackened acres best)
- Fuel Type(s)
- Fuel Loadings (for the various fuels consumed in the daily growth including smolder)
- Fuel Consumption by fuel type by day
- Indication of daily burn intensity which may help quantify plume height
- Smoke transport, impact and concentration information
  - WF = Air Resource Advisor Reports, support documentation and data
    - See wildlandfiresmoke.net
    - BlueSky runs @ 12, 4 and special 1 km runs are archived
  - Rx = Tracking of Basic Smoke Management Practices
- Other sources of data or observations to support source quantification (webcams, lookout tower info., vertical distribution and movement

Data Acquisition

- Best data is at the local level for most elements
  - They have access to wildfire records and daily information
  - They have all the information regarding the prescribed fire
  - Initial request soon after the event is best practice
- Agency Administrator where the fire occurred (Ranger District, National Forest)
- Fuels Specialist or Fire Management Officer at the administrative unit
- There are remote sources for some of the data but validation at the local level should be the norm
  - Remote sources have variable quality
- Rx Fire - Land Management Plan citations for role of fire for the area where the fire occurred